



VPT250-2800S SERIES

HIGH RELIABILITY COTS DC-DC CONVERTERS

Models Available

Input: 16 V to 40 V continuous, 50 V transient
250 W, single output of 3.3 V, 5 V, 12 V, 15 V
-55 °C to 100 °C Operation

1.0 DESCRIPTION

The VPT250 series of isolated COTS DC-DC converters is a cost effective solution for many demanding high reliability applications. A wide input voltage range accommodates nominal 28V inputs including avionics, mobile, ground systems, and other applications. A high efficiency design using synchronous rectification reduces input power requirements and eases thermal management. Low input and output ripple, fixed operating frequency, and current sharing capability simplify system design and compliance. A proven design heritage, no optoisolators and a rugged epoxy encapsulated package ensure long term reliability.

The VPT250 series is intended for harsh environments including severe vibration, shock and temperature cycling. Testing is to JESD22, MIL-STD-810, and MIL-STD-883.

These converters are designed and manufactured in the USA in a facility certified to ISO9001, J-STD-001 and IPC-A-610.

This product may incorporate one or more of the following U.S. patents:

5,784,266
5,790,389
5,963,438
5,999,433
6,005,780
6,084,792
6,118,673



1.1 FEATURES

- High Reliability at Low Cost
- Parallel Up to 5 Units With Current Sharing
- Up to 250 Watts Maximum Output Power
- High Efficiency, Up to 92%
- Wide Input Voltage Range: 16 to 40 Volts per MIL-STD-704 and MIL-STD-1275
- High Input Transient Voltage: 50 Volts for 1 second
- Input Undervoltage Lockout
- Fixed Frequency
- Output Voltage Trim (+10% / -20%)
- Current Limit Protection
- Short Circuit Protection
- Magnetic Feedback, no Optoisolators
- Wide Temperature Range, -55 °C to 100 °C
- Internally Conformal Coated
- 2000 V Isolation
- Rugged Epoxy Encapsulated V-SHIELD® Package
- Fully compatible with Aqueous cleaning process

1.2 COMPLIANCE

- MIL-STD-1275
- MIL-STD-704

1.3 PACKAGING

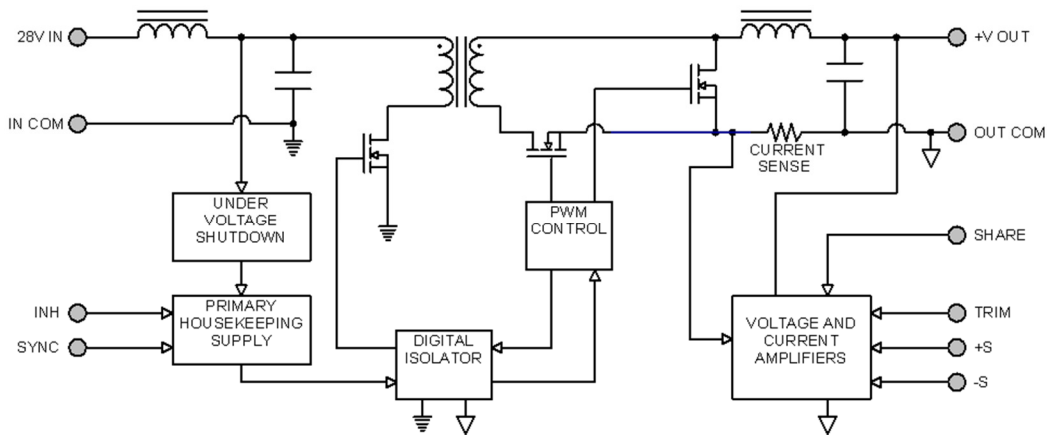
- Low-profile: 2.33" x 2.45" x 0.410"
- Max weight: 118 g

1.4 SIMILAR PRODUCTS AND ACCESSORIES

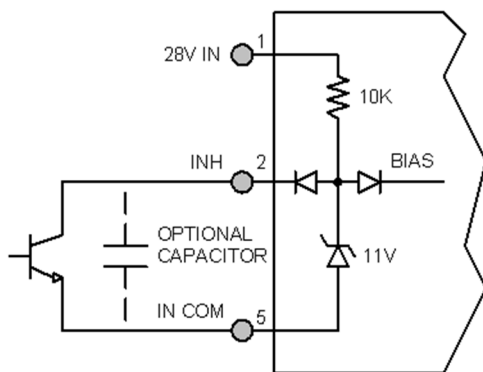
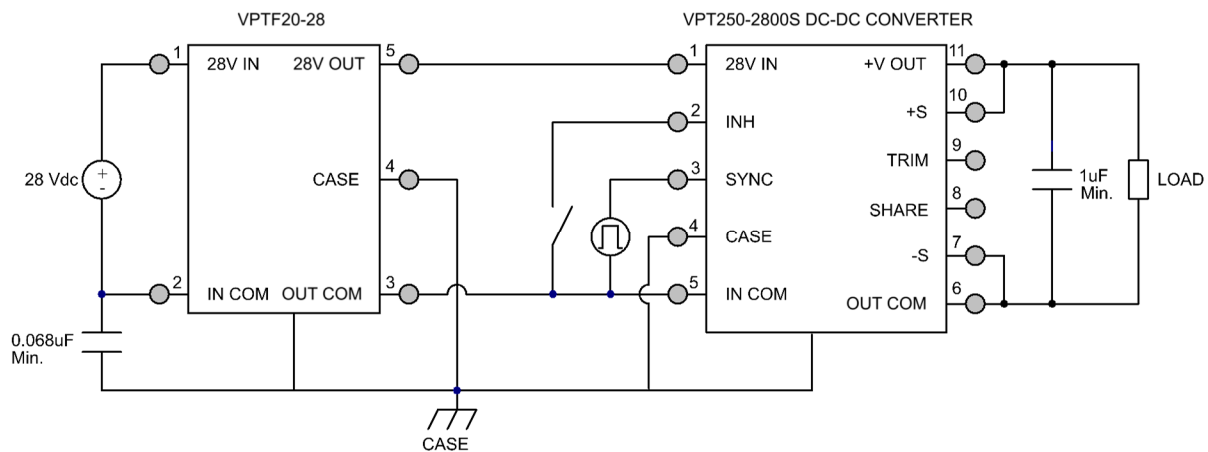
- [DV200](#) 200 W isolated DC-DC converter
- [EMI filters, Thermal Pads, Front-End Modules and Accessories](#)

2.0 DESCRIPTION

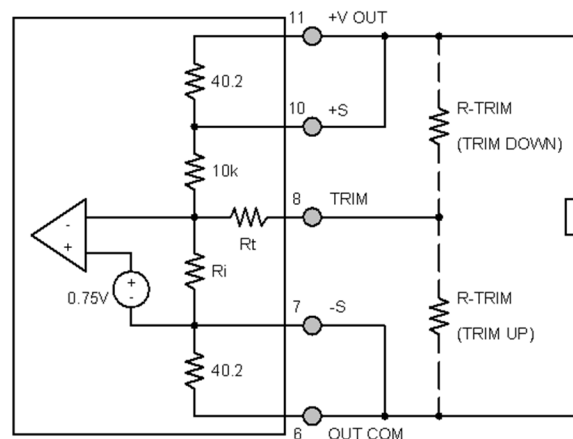
2.1 BLOCK DIAGRAM



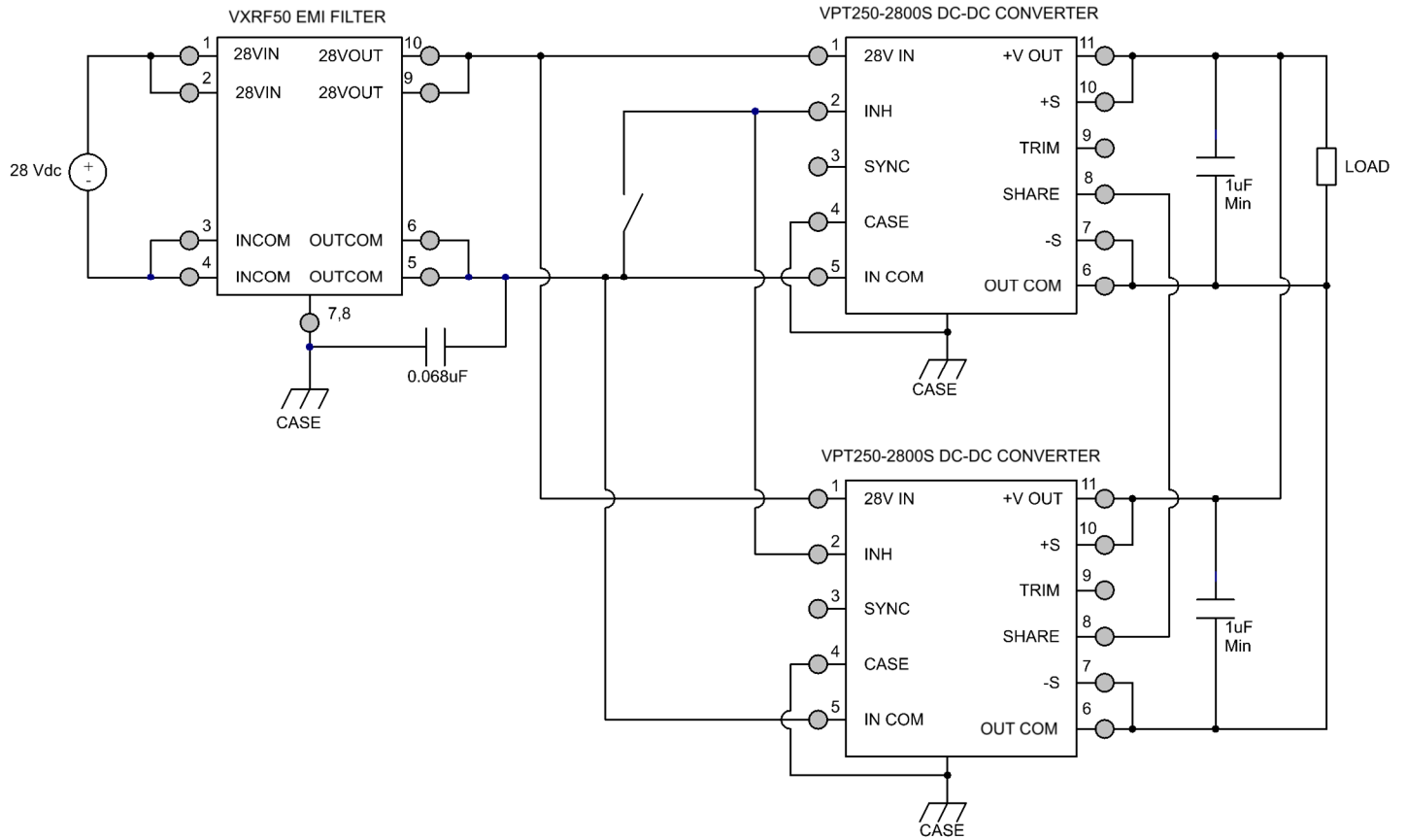
2.2 CONNECTION DIAGRAM



Inhibit Circuit (Shown with optional capacitor for turn-on delay)



Output Voltage Trim Circuit



3.0 SPECIFICATIONS

3.1 ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings			
Input Voltage (Continuous):	40 V	Operating Temperature (Full Load):	-40 °C to 100 °C
Input Voltage (Transient, 1 second):	50 V	Storage Temperature:	-55 °C to 125 °C
		Lead Solder Temperature (10 seconds):	300 °C

3.2 PERFORMANCE SPECIFICATIONS

Tcase = -55 °C to 100 °C, Vin = +28 V ± 5%, Full Load, Unless Otherwise Specified

		VPT250-283R3S			VPT250-2805S			
Parameter	Conditions	Min	Typ	Max	Min	Typ	Max	Units
INPUT								
Voltage	Continuous	16	28	40	16	28	40	V
	Transient, 1 sec ³	-	-	50	-	-	50	V
Current	INH < 1.5 V	-	3.5	5	-	3.5	5	mA
	No Load	-	190	350	-	190	425	mA
Ripple Current	20 Hz to 10 MHz	-	300	500	-	500	700	mAp-p
Undervoltage Lockout	Turn On	15.1	15.5	15.9	15.1	15.5	15.9	V
	Turn Off ³	13.9	14.5	15.1	13.9	14.5	15.1	V
OUTPUT STATIC								
Voltage	Tcase = 25 °C	3.25	3.3	3.35	4.92	5	5.08	V
	Tcase = -55 °C to 100 °C	3.22	3.3	3.38	4.87	5	5.13	V
Power ²		0	-	165	0	-	250	W
Current ²		0	-	50	0	-	50	A
Ripple Voltage ⁴	20 Hz to 10 MHz	-	-	150	-	-	150	mVp-p
Line Regulation	Vin = 16 V to 40 V	-	-	20	-	-	20	mV
Load Regulation	No Load to Full Load	-	-	50	-	-	50	mV
Load Fault Power Dissipation	Overload ³	-	-	50	-	-	50	W
	Short Circuit ³	-	-	50	-	-	50	W
OUTPUT DYNAMIC								
Load Step, 3/4 to Full Load	Output Transient	-	260	400	-	260	400	mVpk
	Recovery ¹	-	250	500	-	250	500	μs
Line Step ³ , Vin = 16 V to 40 V	Output Transient	-	500	750	-	500	750	mVpk
	Recovery ¹	-	300	500	-	300	500	μs
Turn On, Vin = 0 to 28 V	Delay	-	5	10	-	5	10	ms
	Overshoot	-	0	25	-	0	25	mVpk
FUNCTION								
INH Pin Input ³	Output Inhibited	0	-	1.5	0	-	1.5	V
INH Pin Open Circuit Voltage ³	Output Enabled	9	11	14	9	11	14	V
SHARE Pin Voltage ³		0	-	5	0	-	5	V
Current Share Accuracy ³		-	5	-	-	5	-	%
SYNC Frequency Range	VH - VL= 5 V, D = 50%	264	-	336	264	-	336	kHz
GENERAL								
Efficiency		85	88	-	87	90	-	%
Capacitive Load ³		-	-	8,000	-	-	8,000	μF
Switching Frequency		264	300	336	264	300	336	kHz
Isolation	2000 V DC, Tcase = 25 °C	100	-	-	100	-	-	MΩ
Weight		-	-	118	-	-	118	g
MTBF (MIL-HDBK-217F)	GM @ Tcase = 55 °C	-	316	-	-	316	-	kHrs

1. Time for output voltage to settle within 1% of its nominal value.
2. Derate linearly to 0 at 110 °C.
3. Verified by initial electrical design verification. Post design verification, parameter shall be guaranteed to the limits specified.
4. Using recommended minimum external capacitance of 1.0 μF.

3.2 PERFORMANCE SPECIFICATIONS (CONTINUED)

Tcase = -55 °C to 100 °C, Vin = +28 V ± 5%, Full Load, Unless Otherwise Specified

		VPT250-2812S			VPT250-2815S			
Parameter	Conditions	Min	Min	Min	Min	Typ	Max	Units
INPUT								
Voltage	Continuous	16	28	40	16	28	40	V
	Transient, 1 sec ³	-	-	50	-	-	50	V
Current	INH < 1.5 V	-	3.5	5	-	3.5	5	mA
	No Load	-	190	425	-	190	425	mA
Ripple Current	20 Hz to 10 MHz	-	500	700	-	500	700	mAp-p
Undervoltage Lockout	Turn On	15.1	15.5	15.9	15.1	15.5	15.9	V
	Turn Off ³	13.9	14.5	15.1	13.9	14.5	15.1	V
OUTPUT STATIC								
Voltage	Tcase = 25 °C	3.25	12	3.35	4.92	15	5.08	V
	Tcase = -55 °C to 100 °C	3.22	12	3.38	4.87	15	5.13	V
Power ²		0	-	250	0	-	250	W
Current ²		0	-	20.8	0	-	16.7	A
Ripple Voltage ⁴	20 Hz to 10 MHz	-	-	150	-	-	150	mVp-p
Line Regulation	Vin = 16 V to 40 V	-	-	50	-	-	50	mV
Load Regulation	No Load to Full Load	-	-	100	-	-	100	mV
Load Fault Power Dissipation	Overload ³	-	-	50	-	-	50	W
	Short Circuit ³	-	-	50	-	-	50	W
OUTPUT DYNAMIC								
Load Step, 3/4 to Full Load	Output Transient	-	390	700	-	390	700	mVpk
	Recovery ¹	-	250	500	-	250	500	μs
Line Step ³ , Vin = 16 V to 40 V	Output Transient	-	800	1200	-	800	1200	mVpk
	Recovery ¹	-	300	500	-	300	500	μs
Turn On, Vin = 0 to 28 V	Delay	-	5	10	-	5	10	ms
	Overshoot	-	0	50	-	0	50	mVpk
FUNCTION								
INH Pin Input ³	Output Inhibited	0	-	1.5	0	-	1.5	V
INH Pin Open Circuit Voltage ³	Output Enabled	9	11	14	9	11	14	V
SHARE Pin Voltage ³		0	-	5	0	-	5	V
Current Share Accuracy ³		-	5	-	-	5	-	%
SYNC Frequency Range	VH - VL= 5 V, D = 50%	264	-	336	264	-	336	kHz
GENERAL								
Efficiency		89	92	-	89	92	-	%
Capacitive Load ³		-	-	1500	-	-	1500	μF
Switching Frequency		264	300	336	264	300	336	kHz
Isolation	2000 V DC, Tcase = 25 °C	100	-	-	100	-	-	MΩ
Weight		-	-	118	-	-	118	g
MTBF (MIL-HDBK-217F)	GM @ Tcase = 55 °C	-	316	-	-	316	-	kHrs

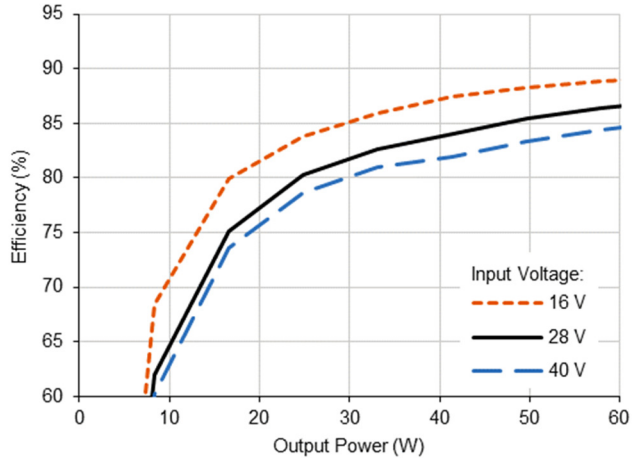
1. Time for output voltage to settle within 1% of its nominal value.
2. Derate linearly to 0 at 110 °C.
3. Verified by initial electrical design verification. Post design verification, parameter shall be guaranteed to the limits specified.
4. Using recommended minimum external capacitance of 1.0 μF.

4.0 PERFORMANCE CURVES

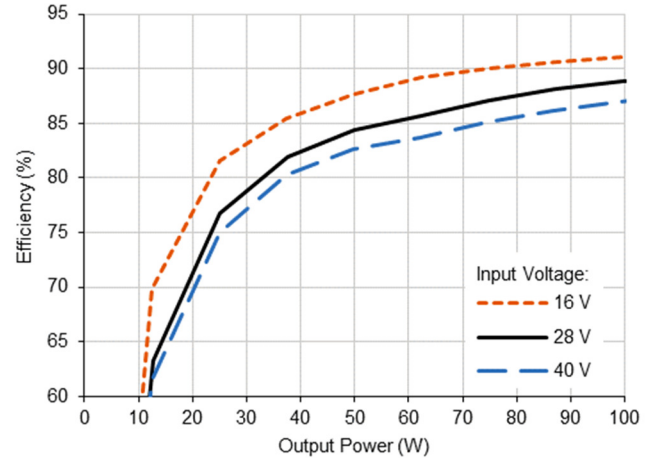
T_{case} = 25° C, Full Load, Unless Otherwise Specified

4.1 EFFICIENCY PERFORMANCE CURVES

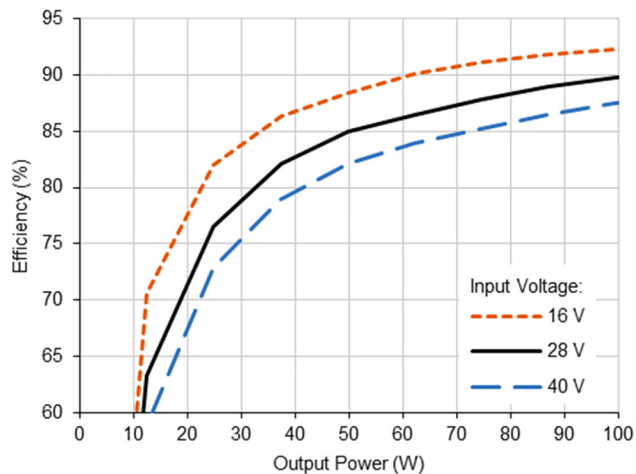
4.1.1 VPT250-283R3S Efficiency (%) vs. Output Power (W)



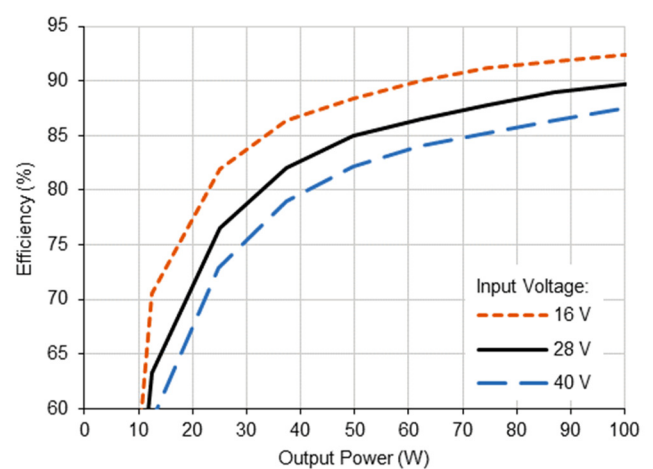
4.1.2 VPT250-2805S Efficiency (%) vs. Output Power (W)



4.1.3 VPT250-2812S Efficiency (%) vs. Output Power (W)

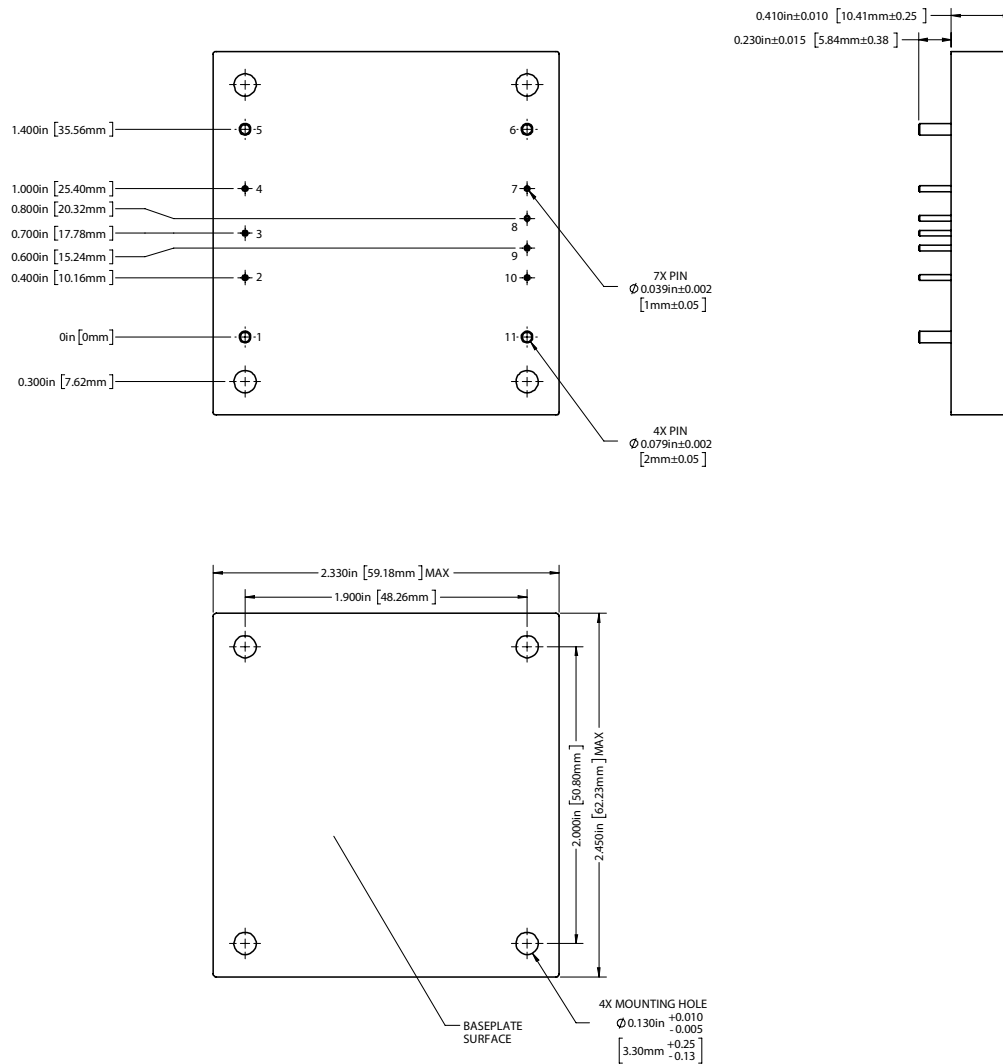


4.1.5 VPT250-2815S Efficiency (%) vs. Output Power (W)



5.0 MECHANICAL OUTLINES AND PINOUT

Standard Package:



- Case temperature is measured on the center of the baseplate surface.
- Materials: Baseplate (Aluminum, conductive conversion coating); Cover (Nickel Plated); Pins (Copper, gold over nickel plating)
- Mounting holes are not threaded. Recommended fastener is 4-40
- This Package is not hermetic. VPT offers a wide range of hermetic products. Please contact VPT for details if hermetic products are required.

Pin	Function	Pin	Function
1	28VIN	7	-SENSE
2	INHIBIT	8	SHARE
3	SYNC	9	TRIM
4	CASE	10	+SENSE
5	INCOM	11	+VOUT
6	OUTCOM		

6.0 PACKAGE PIN DESCRIPTION

Pin	Function	Description
1	28VIN	Positive Input Voltage Connection
2	INHIBIT	This is an open collector input. Logic Low = Disabled Output. Connect the inhibit pin to input common to disable the output. Unconnected, open collector or open drain = Enabled Output.
3	SYNC	Input Synchronization Signal. TTL squarewave, 5 Vpp, 20 - 80% duty cycle, internally capacitively coupled.
4	CASE	Case Connection
5	INCOM	Input Return Connection
6	OUTCOM	Output Return Connection
7	-SENSE	Output Return Remote Sense. Compensate for up to 0.5 V total drop (positive and return).
8	SHARE	Current Share Connection
9	TRIM	Trim Output Voltage to +10%, -20% of Nominal Value. Leave open if not used.
10	+SENSE	Positive Output Voltage Remote Sense. Compensate for up to 0.5 V total drop (positive and return).
11	+VOUT	Positive Output Voltage Connection

7.0 OUTPUT VOLTAGE TRIM

The output voltage can be trimmed down by connecting a resistor between the TRIM pin and the +VOUT pin, or can be trimmed up by connecting a resistor between the TRIM pin and the OUTCOM pin as shown in Section 2.2. The maximum trim range is +10% up and -20% down. The appropriate resistor values versus the output voltage are given in the trim table below.

VPT250-283R3S		VPT250-2805S		VPT250-2812S		VPT250-2815S	
+Vout (V)	Rtrim (Ω)	+ Vout (V)	Rtrim (Ω)	+ Vout (V)	Rtrim (Ω)	+ Vout (V)	Rtrim (Ω)
3.60	3.94k	5.5	980	13.2	1.14k	16.50	686
3.55	8.92k	5.4	4.72k	13.0	2.39k	16.25	1.69k
3.50	16.4k	5.3	10.9k	12.8	4.26k	16.00	3.19k
3.45	28.8k	5.2	23.4k	12.6	7.39k	15.75	5.7k
3.40	53.5k	5.1	60.5k	12.4	13.6k	15.50	10.7k
3.35	127k	5.0	--	12.2	32.4k	15.25	25.9k
3.30	--	4.9	404k	12.0	--	15.00	--
3.25	486k	4.8	189k	11.8	548k	14.75	552k
3.20	226k	4.7	118k	11.6	266k	14.50	270k
3.15	140k	4.6	82.4k	11.4	172k	14.25	175k
3.10	96.9k	4.5	61.1k	11.2	126k	14.00	128k
3.05	71.3k	4.4	46.9k	11.0	97.4k	13.75	99.5k
3.00	54.2k	4.3	36.8k	10.8	78.6k	13.50	80.6k
2.95	42k	4.2	29.2k	10.6	65.3k	13.25	67k
2.90	32.8k	4.1	23.3k	10.4	55.2k	13.00	56.9k
2.85	25.7k	4.0	18.5k	10.2	47.4k	12.75	49k
2.80	20.1k			10.0	41.1k	12.50	42.6k
2.75	15.4k			9.8	36k	12.25	37.5k
2.70	11.5k			9.6	31.8k	12.00	33.2k
2.65	8.26k						

8.0 ENVIRONMENTAL SCREENING

Screening	Condition
Internal Visual	IPC-A-610, Class 3
Stabilization Bake	MIL-STD-883, Method 1008, Condition B, 125°C, 24 hours
Temperature Cycling	MIL-STD-883, Method 1010, Condition B, -55°C to +125°C, 10 Cycles
Burn-In	96 hours at +100°C
Final Electrical	100% at 25 °C
External Visual	Internal Procedure

9.0 ORDERING INFORMATION

VPT250-	28	05	S
1	2	3	4

(1) Product Series	(2) Nominal Input Voltage	(3) Output Voltage	(4) Number of Outputs
VPT250-	28	28 Volts	3R3
		05	3.3 Volts
		12	5 Volts
		15	12 Volts
			15 Volts
		S	Single

Please contact your sales representative or the VPT Inc. Sales Department for more information concerning additional environmental screening and testing, different input voltage, output voltage, power requirements, and source inspection.

10.0 CONTACT INFORMATION

To request a quotation or place orders please contact your sales representative or the VPT, Inc. Sales Department at:

Phone: (425) 353-3010
Fax: (425) 353-4030
E-mail: vptsales@vptpower.com

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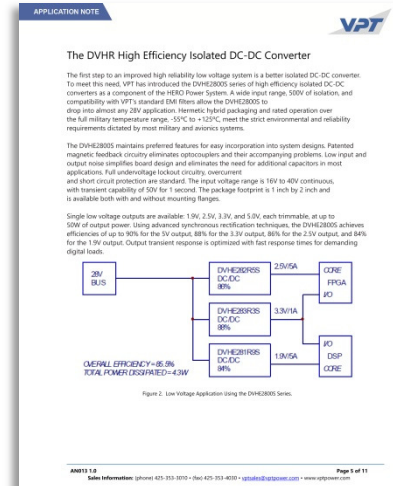
11.0 ADDITIONAL INFORMATION

Visit the [VPT website](http://www.vptpower.com) for additional technical resources, including:

[Product Literature](#)



[Application Notes and White Papers](#)



[Technical Video Labs](#)



[Additional Products For Avionics/Military, Hi-Temp, Hi-Rel COTS, and Space Applications](#)

